MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 2, 2019/2020**

## PIP0255 – INTRODUCTION to PHYSICS

(Foundation in Information Technology)

3 March 2020
9.00 A.M – 11.00 A.M
(2 Hours)

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**INSTRUCTIONS TO STUDENT**

1. This question paper consists of 4 printed pages with 5 questions only, excluding the cover page, physical constants, and formula list.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

**LIST OF PHYSICAL CONSTANTS**

| | | |
|---|---|---|
| Acceleration due to gravity | $g$ | $9.80\ \text{m/s}^2$ |
| Electron mass | $m_e$ | $9.11 \times 10^{-31}\ \text{kg}$ |
| Proton mass | $m_p$ | $1.67 \times 10^{-27}\ \text{kg}$ |
| Elementary Charge | $e$ | $1.602 \times 10^{-19}\ \text{C}$ |
| Coulomb Constant | $k$ | $9.0 \times 10^{9}\ \text{N m}^2\text{. C}^{-2}$ |
| Permittivity of free space | $\varepsilon_0$ | $8.85 \times 10^{-12}\ \text{C}^2\text{N}^{-1}\text{.m}^{-2}$ |

**LIST OF FORMULA**

## NEWTONIAN MECHANICS

$$\omega = \frac{\Delta\theta}{\Delta t} \qquad v = r\omega \qquad a = r\alpha$$

$$\omega = \omega_o + \alpha t \qquad \theta = \frac{1}{2}(\omega_0 + \omega)t \qquad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\theta \qquad \theta = \omega t - \frac{1}{2}\alpha t^2 \qquad W = Fs\cos\theta$$

$$KE = \frac{1}{2}mv^2 \qquad PE_G = mgy \qquad p = mv \qquad \sum F = \frac{\Delta p}{\Delta t}$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \qquad m_1u_1 + m_2u_2 = (m_1 + m_2)\,v$$

## ELECTRICITY

$q = Ne$

$F = k\frac{q_1 q_2}{r^2}$

$E = \frac{F}{q_o}$

$C = \frac{\varepsilon_0 A}{d}$

$Q = CV$

$C = \kappa C_0$

$C_{eq} = C_1 + C_2 + \ldots.$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots.$

$V = E\,d$

$U = \frac{1}{2} QV$

$U = \frac{1}{2} CV^2$

$U = \frac{Q^2}{2C}$

$I_{av} = \frac{\Delta Q}{\Delta t}$

$V = IR$

$R = \rho\frac{L}{A}$

$R_{eq} = R_1 + R_2 + \ldots$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

$P = IV$

$P = I^2 R$

$P = \frac{V^2}{R}$

## STRUCTURED QUESTIONS [50 MARKS]

**Instructions:** Answer **ALL** questions in this section.

### Question 1 [10 marks]

a. A carousel is initially at rest. At $t = 0$ it is given a constant acceleration $\alpha = 0.050$ rad/s$^2$ , which increases it's angular velocity for 10.0 s. At $t = 10.0$ s determine the following quantities:

i. the angular velocity of the carousel. (1 mark)
ii. the linear velocity of a child located 2.5 m from the center. (1 mark)
iii. the the tangential ( linear ) acceleration of that child. (1 mark)
iv. the centrepetal acceleration of the child. (1 mark)

b. A bicycle slows down uniformly from $v_o = 8.0$ m/s to rest over a distance of 110 m. Each wheel has an overall diameter of 65.0 cm. Calculate

i. the angular velocity of the wheel at the initial instant ( $t = 0$ ) (1 mark)
ii. the total number of revolutions each wheel rotates ( in radian ) before coming to rest. (2 marks)
iii. the angular acceleration of the wheel. ( 2 marks)
iv. the time it took to come to a stop. (1 mark)

### Question 2 [10 marks]

a. A 1.5 m tall person lifts a 2.00 kg book from the ground so it is 2.5 m above the ground. What is the potential energy of the book relative to

i. the ground ? (1 mark)
ii. the top of the person's head ? (1 mark)

b. A 280 kg load is lifted 22.0 m vertically with an acceleration $\boldsymbol{a} = 0.15\boldsymbol{g}$ by a single cable.

i. Draw a free-body diagram of the load. (1 mark)
ii. Determine the tension in the cable. (2 marks)
iii. Calculate the work done by the cable on the load. (1 mark)

c. A 15.0 kg object moving in the $+x$ direction at 5.5 m/s collides head-on with a 10.0 kg object moving in the $-x$ direction at 4.0 m/s. Find the final velocity of each mass if

i. the objects stick together. (2 marks)
ii. the 15.0 kg object is at rest after collision. (2 marks)

**Continued...**

**Question 3 [10 marks]**

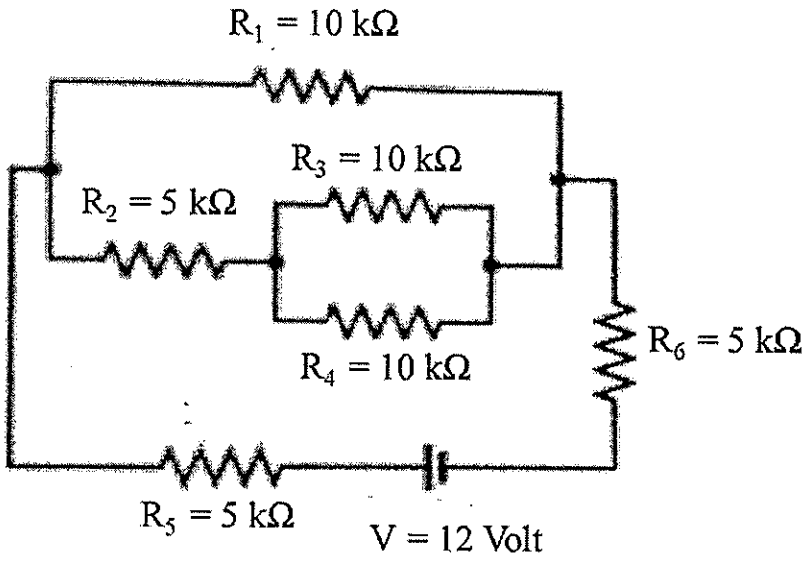


**Figure Q3**

A 12.0 Volt battery is connected in the circuit as shown in **Figure Q3**

a. Calculate the equivalent resistance. (5 marks)

b. How much current is drawn from the battery? (1 mark)

c. What is the current flows through the $R_2$ resistor? (2 marks)

d. Determine the voltage across $R_2$ and $R_5$ resistors. (2 marks)

**Question 4 [10 marks]**

a. i. Define Coulomb's law (1 mark)

ii State Law of Charges. (1 mark)

**Continued...**

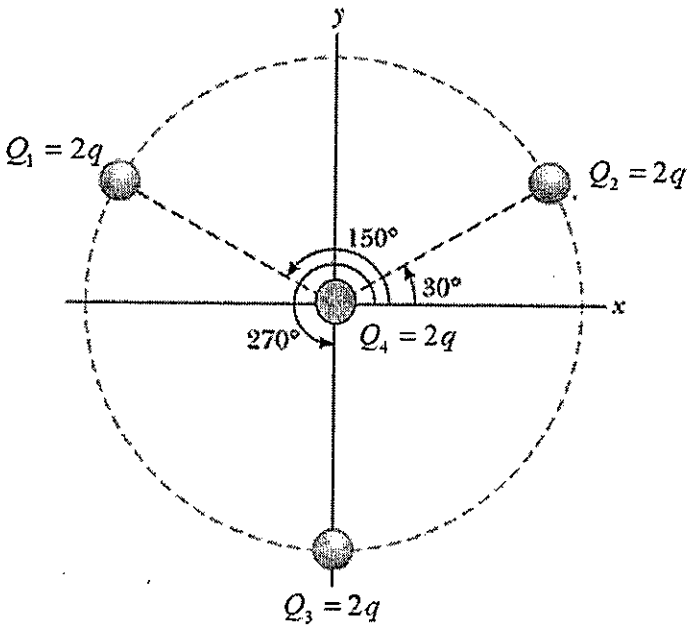


**Figure Q4(b)**

b. **Figure Q4(b)** shows four identical charges ( $q$ = -5 μC ). Three of the charges lie along a circle of radius 2.0 m at angles of 30°, 150°, and 270°, as shown. What is the resultant electric force at $Q_4$, which is at the center of the circle? (8 marks)

**Question 5 [10 marks]**

a. Define the following terms

i. Doping.
ii. *p*-type semiconductor. (1 mark)

b. Explain how a pure semiconductor is changed to *n*-type semiconductor. (4 marks)

**Continued...**

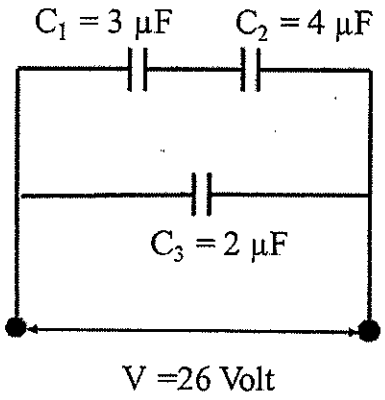


**Figure Q5(c)**

c. A 3.00 μF and a 4.00 μF capacitor are connected in series and this combination is connected in parallel with a 2.00 μF capacitor (**Figure Q5(c)**).

i. What is the net capacitance? (2 marks)

ii. If 26.0 V is applied across the whole network of **Figure Q5(c)**, calculate the voltage across $C_1$ and $C_2$ capacitor. (3 marks)

**End of Paper**